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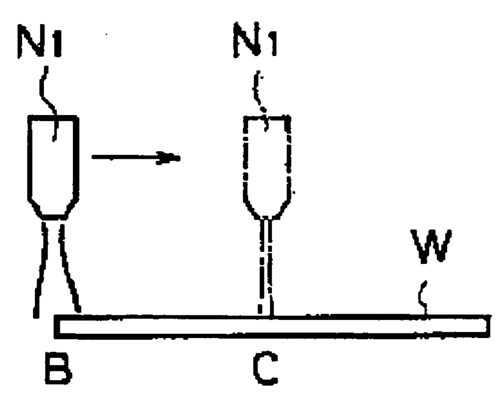
(54) FILM FORMATION METHOD AND FILM FORMATION APPARATUS

(57)Abstract:

PROBLEM TO BE SOLVED: To form a uniform film of a treatment liquid on a substrate with no vain supply of the treatment liquid to the substrate.

SOLUTION: While a wafer W being rotated, a resist liquid jetting nozzle N1 for jetting a resist liquid to the wafer W is moved at an equal speed along the radial direction of the wafer W. During the movement, the amount of the resist liquid to be jetted out of the resist liquid jetting nozzle N1 is gradually lessened. The resist liquid jetted to the wafer W is applied to the surface of the wafer W while drawing the spiral track and the amount of the resist liquid applied to a unit surface area is even in the peripheral part B and in the center part C of the wafer W.



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CLAIMS

[Claim(s)]
[Claim 1] The film formation approach which make rotate this substrate further, and is the approach of forming the film of processing liquid on said substrate, make carry out uniform migration of the nozzle along the direction of a path from the periphery of a substrate to the center section of a substrate, and is characterized by to decrease gradually the amount of supply of the processing liquid supplied to a substrate during this migration while supplying the processing liquid breathed out from the nozzle to a substrate.
[Claim 2] The film formation approach according to claim 1 which is made to carry out uniform migration of said nozzle along the direction of a path from the center section of a substrate to the periphery of a substrate further, and is characterized by making the amount of supply of the processing liquid supplied to a substrate during this migration increase gradually.
[Claim 3] The film formation approach which make rotate this substrate further, and is the approach of forming the film of processing liquid on said substrate, and make the uniform migration of the nozzle carry out in the direction of a path from the center section of a substrate to the periphery of a substrate, and is characterized by to make the amount of supply of the processing liquid supplied to a substrate during this migration increase gradually while supplying the processing liquid breathed out from the nozzle to a substrate.
[Claim 4] The film formation approach according to claim 3 which is made to carry out uniform migration of said nozzle along the direction of a path from the periphery of a substrate to the center section of a substrate further, and is characterized by decreasing gradually the amount of supply of the processing liquid supplied to a substrate during this migration.
[Claim 5] The film formation approach which this substrate is rotated further, is the approach of forming the film of processing liquid on said substrate, and is characterized by supplying processing liquid to a substrate while making it move so that a nozzle may be gradually accelerated along the direction of a path from the periphery of a substrate to the center section of a substrate while supplying the processing liquid breathed out from the nozzle to a substrate.
[Claim 6] The film formation approach according to claim 5 characterized by supplying processing liquid to a substrate while making it move so that said nozzle may be further slowed down gradually from the center section of a substrate to the periphery of a substrate.
[Claim 7] The film formation approach which this substrate is rotated further, is the approach of forming the film of processing liquid on said substrate, and is characterized by supplying processing liquid to a substrate while making it move so that a nozzle may be gradually slowed down along the direction of a path from the center section of a substrate to the periphery of a substrate while supplying the processing liquid breathed out from the nozzle to a substrate.
[Claim 8] The film formation approach according to claim 7 characterized by supplying processing liquid to a substrate while making it move so that said nozzle may be further accelerated gradually from the periphery of a substrate to the center section of a substrate.
[Claim 9] The film formation approach given in either of claims 1, 2, 3, 4, 5, 6, 7, or 8 which is characterized by changing the rotational speed of a substrate during migration of said nozzle.
[Claim 10] The film formation approach given in either of claims 1, 2, 3, 4, 5, 6, 7, 8, or 9 which is characterized by repeating migration of said nozzle which met in the direction of a path of a substrate, and performing it.

[Claim 11] The film formation approach given in either of claims 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10 which is characterized by changing the viscosity of the processing liquid supplied during migration of said nozzle at a substrate.
[Claim 12] The 1st migration process which it is [1st] the approach of making rotate this substrate further and forming the film of processing liquid on said substrate while supplying the processing liquid breathed out from the nozzle to a substrate, and turns and moves a nozzle to the center section of a substrate, The film formation approach characterized by decelerating said nozzle gradually after supplying processing liquid to the center section of a substrate, if it has the 2nd migration process to which a nozzle is continuously moved towards a periphery from a center section after that and is in said 2nd migration process.
[Claim 13] The film formation approach according to claim 12 characterized by decelerating the rotational speed of a substrate gradually if it is in said 2nd migration process.
[Claim 14] It is film formation equipment characterized by the ability of this acceptance member to be able to move freely between said predetermined locations and positions in readiness by rotating this substrate further, being equipment which forms the film of processing liquid on said substrate, and having the acceptance member which catches the processing liquid breathed out from the discharge opening of said nozzle to a substrate in the predetermined location of the lower part of said discharge opening while supplying to a substrate the processing liquid which breathed out from a nozzle.
[Claim 15] The process which rotates said substrate in the approach of forming the film of processing liquid on a substrate, The process which supplies said processing liquid breathed out from the nozzle on said rotating substrate, So that the processing liquid to which the location on the substrate of the processing liquid supplied from said nozzle is supplied the process of said rotating substrate which moves in the direction of a path mostly, and on said substrate may become homogeneity The film formation approach characterized by providing the process which performs control of either the rotational speed of said substrate, the amount of supply of said processing liquid or the passing speed of said nozzle at least.
[Claim 16] The film formation approach according to claim 15 characterized by being that from which said migration process moves the location on the substrate of the processing liquid supplied from said nozzle in the direction of a path of said rotating substrate by carrying out adjustable [of the include angle of said nozzle and said substrate to make].
[Claim 17] The film formation approach given in claim 15 or either of 16 which is characterized by providing the process which changes the path of said nozzle according to the class of said processing liquid.
[Claim 18] The film formation approach given in claims 15 and 16 or either of 17 which is characterized by being that to which said processing liquid supply process supplies said processing liquid which breathed out said substrate top from the nozzle with the bonnet with covering on said rotating substrate.
[Claim 19] The film formation approach given in claims 15, 16, and 17 or either of 18 which is characterized by being that by which said processing liquid supply process supplies said processing liquid breathed out from the nozzle on said rotating substrate while carrying out temperature control to said substrate.
[Claim 20] Said migration process passes along the center section of a substrate from the 1st periphery of a substrate. With said 1st periphery to the 2nd periphery of an opposite hand It is also moving a nozzle along the direction of a path. Said substrate from said 1st periphery to said center section [said revolution process] It is the film formation approach according to claim 15 characterized by rotating said substrate in the 1st direction while moving, and said 1st direction rotating said substrate in the 2nd direction of an opposite direction while said substrate moves from said center section to said 2nd periphery.
[Claim 21] The film formation approach given in claims 15, 16, 17, 18, and 19 or either of 20 which is characterized by having further the process to which said control activation process is made to carry out preferentially.
[Claim 22] The process which rotates said substrate in the approach of forming the film of processing liquid on a substrate, Said processing liquid which supplied said processing liquid breathed out from the 1st nozzle to the 1st field from the center section of said rotating substrate to

the range of a predetermined radius of gyration, and was breathed out from the 2nd nozzle to the 2nd field from said predetermined radius of gyration to the range of the periphery of the substrate outside said predetermined radius of gyration So that the processing liquid to which the process to supply, and said the 1st nozzle and 2nd nozzle are simultaneously supplied the process of said rotating substrate which moves in the direction of a path mostly, and on said substrate may become homogeneity The film formation approach characterized by providing the process which performs one control of the passing speed of the rotational speed of said substrate, the amount of supply of said processing liquid or said 1st nozzle, and the 2nd nozzle at least.
[Claim 23] The film formation approach according to claim 22 characterized by being what said migration process turns said 1st nozzle to said predetermined radius of gyration from the center section of said substrate, and moves, and turns said 2nd nozzle to said predetermined radius of gyration from the periphery of said substrate, and moves.

[Translation done.]

* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the film formation approach and film formation equipment which supply processing liquid to a substrate and form the film of processing liquid.
[0002]
[Description of the Prior Art] For example, at the lithography process in semiconductor device manufacture, it has various down stream processing, such as resist spreading down stream processing which applies resist liquid to front faces, such as a semi-conductor wafer (henceforth a "wafer"), exposure down stream processing which exposes the wafer after resist spreading processing, and a development process which develops the wafer after exposure processing. And in resist spreading down stream processing, the spin coat method is adopted conventionally.
[0003] This spin coat method trickles the resist liquid of the specified quantity into the center section of a wafer, rotates a wafer, diffuses the resist liquid of a center section on the wafer concerned according to a centrifugal force, and forms the resist film.
[0004] By the way, in order to aim at improvement in the product yield, it is required to form the uniform resist film on the surface of a wafer. Therefore, a wafer is rotated at high speed, and he diffuses resist liquid and was trying to spread resist liquid enough to the periphery of a wafer according to a centrifugal force in the conventional spin coat method.
[0005]
[Problem(s) to be Solved by the Invention] However, when the wafer was rotated such at high speed, the resist liquid which disperses from the front face of a wafer increased in number, and there was futility. In having rotated the wafer at a low speed, in order to prevent this, the applied resist liquid could not fully be spread to the periphery of a wafer, and the uniform resist film was not able to be formed.
[0006] Then, this invention loses futility which was described above, reduction-ization of processing liquid can be attained, and it offers the film formation approach and film formation equipment which can be formed on a substrate for the film of uniform processing liquid, and aims at solving the above-mentioned technical problem.
[0007]
[Means for Solving the Problem] In order to attain the above-mentioned object, while supplying the processing liquid breathed out from the nozzle to a substrate according to claim 1 It is the approach of making rotate this substrate furthermore and forming the film of processing liquid on said substrate. From the periphery of a substrate to the center section of a substrate The film formation approach which is made to carry out uniform migration of the nozzle along the direction of a path, and is characterized by decreasing gradually the amount of supply of the processing liquid supplied to a substrate during this migration is offered.
[0008] Since the regurgitation of the processing liquid is carried out to the substrate which rotates from the nozzle which carries out uniform migration along the direction of a path of a substrate according to the film formation approach according to claim 1, processing liquid is supplied drawing a spiral locus on a substrate. Since the processing liquid amount of supply is applied to the center section of a substrate and is gradually decreased from the periphery of a substrate at this time, processing liquid can be supplied on a substrate at homogeneity. Therefore, it can become

unnecessary to diffuse processing liquid with a centrifugal force like before, even if it makes a revolution of a wafer into a low speed, the film of uniform processing liquid can be formed, and scattering of the processing liquid from a substrate can also be prevented.
[0009] Invention according to claim 2 is the film formation approach according to claim 1, carries out uniform migration of said nozzle along the direction of a path from the center section of a substrate to the periphery of a substrate further, and is characterized by making the amount of supply of the processing liquid supplied to a substrate during this migration increase gradually.
[0010] According to the film formation approach according to claim 2, the nozzle which moved to the center section of a substrate from the periphery of a substrate is further moved to the periphery of a substrate, and the processing liquid amount of supply to a substrate is made to increase gradually during migration of the nozzle from a center section to a periphery. Therefore, since processing liquid can be supplied twice [a total of] on a substrate as a spiral locus is drawn, the supply nonuniformity of processing liquid can be prevented more certainly than the case of claim 1. Furthermore, since the processing liquid amount of supply is gradually decreased on the occasion of migration of the nozzle from a center section to a periphery, it is possible to **** the processing liquid amount of supply per unit area ana by the center section and the periphery also in this case. Consequently, the film of more uniform processing liquid can be formed on a substrate. In addition, the regurgitation initiation point of the processing liquid at the time of carrying out uniform migration of the periphery of the substrate indicated to claim 1, i.e., the nozzle, is sufficient as a periphery, and other peripheries are sufficient as it.
[0011] While supplying to a substrate the processing liquid breathed out from the nozzle according to claim 3, this substrate rotates further, it is the approach of forming the film of processing liquid on said substrate, and the film formation approach which make the uniform migration of the nozzle carry out in the direction of a path from the center section of a substrate to the periphery of a substrate, and is characterized by to make the amount of supply of the processing liquid supplied to a substrate during this migration increase gradually is offered.
[0012] Since processing liquid is supplied to the center section of the substrate which rotates from the nozzle which carries out uniform migration along the direction of a path of a substrate according to the film formation approach according to claim 3, processing liquid is supplied on a substrate, drawing a spiral locus. And since the processing liquid amount of supply is made to increase gradually in case a nozzle moves from the center section of a substrate to a periphery, equivalent processing liquid can be supplied to the center section and periphery of a substrate per unit area, and the film of uniform processing liquid can be formed on a substrate. Therefore, it becomes unnecessary to rotate a substrate like before at high speed, and to diffuse processing liquid to the periphery of a substrate. Consequently, scattering of processing liquid can be prevented like the case of claim 1.
[0013] Invention according to claim 4 is the film formation approach according to claim 3, carries out uniform migration of said nozzle along the direction of a path from the periphery of a substrate to the center section of a substrate further, and is characterized by decreasing gradually the amount of supply of the processing liquid supplied to a substrate during this migration.
[0014] He moves further the nozzle which moved to the periphery of a substrate from the center section of a substrate to the center section of a substrate, and is trying to decrease the processing liquid amount of supply gradually during migration of the nozzle from a periphery to a center section according to the film formation approach according to claim 4. Therefore, processing liquid can be supplied twice [a total of], as a spiral locus can be drawn, and the supply nonuniformity of processing liquid to a substrate can be prevented more certainly than the case of claim 3. Moreover, it is possible to **** the processing liquid amount of supply per unit area ana in a periphery and the center section also in this case. Consequently, the film of more uniform processing liquid can be formed on a substrate. In addition, the regurgitation initiation point of the processing liquid at the time of carrying out uniform migration of the periphery of the substrate indicated to claim 3, i.e., the nozzle, is sufficient as a periphery, and they may be other peripheries.
[0015] While supplying the processing liquid breathed out from the nozzle to a substrate according to claim 5, this substrate is rotated further, it is the approach of forming the film of processing liquid on said substrate, and the film formation approach characterized by to supply processing liquid to a

substrate is offered, making it move so that a nozzle may be gradually accelerated along the direction of a path from the periphery of a substrate to the center section of a substrate.
[0016] This nozzle is succeedingly moved to the center section of a substrate, supplying processing liquid to the periphery of the rotating substrate from a nozzle according to the film formation approach according to claim 5. The processing liquid amount of supply to a substrate decreases as a nozzle goes to the center section of a substrate from the periphery of a substrate, since the passing speed of the nozzle from a periphery to a center section is gradually accelerated along the direction of a path of a substrate at this time. And since the rotation distance per unit time amount is longer than a center section, also in this case, like the case of claim 1, a periphery can supply equivalent processing liquid to the periphery and center section of a substrate to rotate per unit area, and it becomes possible [forming the film of uniform processing liquid on a substrate].
[0017] Invention according to claim 6 is the film formation approach according to claim 5, and it is characterized by supplying processing liquid to a substrate, making it move so that said nozzle may be further slowed down gradually from the center section of a substrate to the periphery of a substrate.
[0018] He is trying to move further the nozzle which moved from the periphery of a substrate to the center section of a substrate to the periphery of a substrate according to the film formation approach according to claim 6. Therefore, like the case of claim 2, processing liquid can be supplied twice [a total of], as a spiral locus can be drawn on a substrate, and it can prevent more certainly that the supply nonuniformity of processing liquid occurs. Moreover, since the passing speed of the nozzle from the center section of a substrate to the periphery of a substrate is decelerated gradually, equivalent processing liquid can be supplied per unit area to the periphery and center section of a substrate to rotate. In addition, you may be the regurgitation initiation point of the processing liquid at the time of carrying out acceleration migration of the periphery of the substrate indicated to claim 5 as a periphery, i.e., the nozzle, and may be other peripheries.
[0019] While supplying the processing liquid breathed out from the nozzle to a substrate according to claim 7, this substrate is rotated further, it is the approach of forming the film of processing liquid on said substrate, and the film formation approach characterized by supplying processing liquid to a substrate is offered, making it move so that a nozzle may be gradually slowed down along the direction of a path from the center section of a substrate to the periphery of a substrate.
[0020] This nozzle is succeedingly moved to the periphery of a substrate, supplying processing liquid to the center section of the rotating substrate from a nozzle according to the film formation approach according to claim 7. The processing liquid amount of supply to a substrate increases as a nozzle goes to the periphery of a substrate from the center section of a substrate, since the passing speed of the nozzle from a center section to a periphery is gradually decelerated along the direction of a path of a substrate at this time. And since the rotation distance per unit time amount is longer than a center section, also in this case, like the case of claim 5, a periphery can supply equivalent processing liquid to the periphery and center section of a substrate to rotate per unit area, and it becomes possible [forming the film of uniform processing liquid on a substrate].
[0021] In this case, you may make it supply processing liquid to a substrate, making it move like claim 8, so that said nozzle may be further accelerated gradually from the periphery of a substrate to the center section of a substrate.
[0022] According to the film formation approach according to claim 8, the nozzle located in the periphery of a substrate is further moved to the center section of a substrate. Therefore, since processing liquid can be spirally supplied twice [a total of] on the surface of a substrate, the supply nonuniformity of processing liquid can be prevented more certainly than the case of claim 7. And since a nozzle is moved from the periphery of a substrate to a center section as it accelerates gradually, the processing liquid amount of supply per [to a periphery and a center section] unit area can be ana ****ed also in this case.
[0023] Invention according to claim 9 is characterized by changing the rotational speed of a substrate to either of claims 1, 2, 3, 4, 5, 6, 7, or 8 during migration of said nozzle in the film formation approach of a publication.
[0024] Since it was made to also change the rotational speed of a substrate suitably besides adjusting the processing liquid amount of supply and the passing speed of a nozzle when according to the film

formation approach according to claim 9 moving a nozzle and supplying processing liquid to a substrate, it is possible to adjust the rotation distance per unit time amount. Therefore, in forming the film of processing liquid on a substrate, it becomes possible to perform more detailed control.
[0025] Invention according to claim 10 is characterized by repeating migration of said nozzle which met in the direction of a path of a substrate to either of claims 1, 2, 3, 4, 5, 6, 7, 8, or 9, and performing it to it in the film formation approach of a publication.
[0026] According to the film formation approach according to claim 10, it is carrying out by repeating migration of the nozzle which met in the direction of a path of a substrate, for example, two coats of processing liquid can also be given on a substrate. Therefore, the supply nonuniformity of the processing liquid on a substrate can be prevented still more certainly.
[0027] Invention according to claim 11 is the film formation approach given in either of claims 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10, and is characterized by changing the viscosity of the processing liquid supplied during migration of said nozzle at a substrate.
[0028] During migration of a nozzle, about spreading near the core of a substrate, when discharge quantity increases beyond the need, the film of a core may become thick. If it is made to change the viscosity of this point and the processing liquid supplied to a substrate like claim 11, by lowering the viscosity of the processing liquid at the time of applying in a core, for example, by the fluidity of processing liquid, and revolution of a substrate, the film of processing liquid can be made thin, when above, the thickness in a core can be adjusted and homogeneity can be raised as a whole. In addition, in order to adjust the viscosity of processing liquid such, it can propose mixing and supplying the solvent of processing liquid.
[0029] While supplying the processing liquid breathed out from the nozzle to a substrate according to claim 12 The 1st migration process which it is [1st] the approach of making rotate this substrate furthermore and forming the film of processing liquid on said substrate, and turns and moves a nozzle to the center section of a substrate, If it has the 2nd migration process to which a nozzle is continuously moved towards a periphery from a center section after that and is in said 2nd migration process, after supplying processing liquid to the center section of a substrate, the film formation approach characterized by decelerating said nozzle gradually is offered.
[0030] Migration of a nozzle is started, for example towards the center section of a substrate at the 1st migration process, and supply of processing liquid is started in the center section of a substrate, and it is made to move to the periphery of a substrate according to the film formation approach according to claim 12, decelerating this nozzle gradually after that. Therefore, it is easy to secure the passing speed of a nozzle to predetermined passing speed in the center section of a substrate, and subsequent slowdown migration can be performed easily. And like the case of each claim as stated above, as a spiral locus is drawn on a substrate, processing liquid can be supplied to a substrate at homogeneity.
[0031] Invention according to claim 13 is the film formation approach according to claim 12, and is characterized by decelerating the rotational speed of a substrate gradually in said 2nd migration process.
[0032] Since according to the film formation approach according to claim 13 the rotational speed of a substrate is also gradually decelerated while decelerating the passing speed of a nozzle gradually at the 2nd migration process, it faces forming the film of processing liquid on a substrate, and adjustment more detailed than claim 12 is attained.
[0033] While supplying the processing liquid breathed out from the nozzle to a substrate according to claim 14 Are equipment which is made to rotate this substrate furthermore and forms the film of processing liquid on said substrate, and a substrate is received from the discharge opening of said nozzle. It has the acceptance member which catches the processing liquid breathed out in the predetermined location of the lower part of said discharge opening, and the film formation equipment characterized by the ability of this acceptance member to move freely between said predetermined locations and positions in readiness is offered. Here, the location where, as for a position in readiness, an acceptance member does not catch the processing liquid breathed out from the nozzle is said.
[0034] If according to film formation equipment according to claim 14 the processing liquid breathed out from the nozzle when the acceptance member was located in the position in readiness is

supplied as it is to a substrate and an acceptance member is located in a predetermined location, it is possible to catch the processing liquid breathed out from the nozzle by the acceptance member. Therefore, the responsibility at the time of supplying processing liquid to a substrate or suspending supply of processing liquid to a substrate by migration of the acceptance member between a predetermined location and a position in readiness, to it, since a halt and supply of processing liquid to a substrate can be performed improves. So, in enforcing the film formation approach according to claim 1 to 13, supply initiation of the processing liquid in the periphery of a substrate and a center section and supply interruption can be performed promptly, and these approaches can be enforced suitably.

[0035] In the approach of forming the film of processing liquid on a substrate according to invention of claim 15 The process turning around said substrate, and the process which supplies said processing liquid breathed out from the nozzle on said rotating substrate, So that the processing liquid to which the location on the substrate of the processing liquid supplied from said nozzle is supplied the process of said rotating substrate which moves in the direction of a path mostly, and on said substrate may become homogeneity The film formation approach characterized by providing the process which performs control of either the rotational speed of said substrate, the amount of supply of said processing liquid or the passing speed of said nozzle at least is offered.

[0036] Thus, since the need of carrying out the high-speed revolution of the substrate like before by moving a nozzle and supplying processing liquid on a substrate is lost, processing liquid does not disperse vainly according to a centrifugal force, and reduction-ization of processing liquid is attained. Moreover, the rotational speed of a substrate, the amount of supply of said processing liquid, or the passing speed of said nozzle can be controlled to it and coincidence, and the film of uniform processing liquid can be formed on a substrate.

[0037] In the film formation approach of this claim 15, like claim 16, said migration process moves the location on the substrate of the processing liquid supplied from said nozzle in the direction of a path of said rotating substrate, and may be made to be performed by carrying out adjustable [of the include angle of said nozzle and said substrate to make]. Thus, even if it does not supply processing liquid on a substrate but supplies processing liquid to a substrate by carrying out adjustable [of said include angle of a nozzle], and making the discharge direction of a nozzle change, moving the location of a nozzle, the film of uniform processing liquid can be formed on a substrate like claim 15, reduction-izing the amount of processing liquid.

[0038] Moreover, you may make it have the process which changes the path of said nozzle according to the class of said processing liquid like claim 17. The processing liquid stabilized on the substrate by it being more desirable to change the path of a nozzle according to processing liquid like claim 17, and carrying out like this in order to carry out the regurgitation of the processing liquid stabilized proper from the nozzle according to the class by the processing liquid which forms the film since viscosity differed from surface tension is supplied, and the uniform film is formed.

[0039] Furthermore, in each film formation approach of claims 15-17, like claim 18, said processing liquid supply process supplies said processing liquid which breathed out said substrate top from the nozzle with the bonnet with covering on said rotating substrate, and may be made to be performed. Thus, since the ambient atmosphere on a substrate is maintained by the predetermined ambient atmosphere by covering a substrate top with covering, processing liquid is supplied in the proper and stabilized ambient atmosphere, and film formation of processing liquid can be performed suitably.

[0040] In each film formation approach of claims 15-18 mentioned above, carrying out temperature control to said substrate, like claim 19, said processing liquid supply process supplies said processing liquid breathed out from the nozzle on said rotating substrate, and may be made to be performed. Thus, the ambient atmosphere on the substrate with which the film of processing liquid is formed is maintainable to predetermined temperature by supplying processing liquid on a substrate, carrying out temperature control to a substrate. Therefore, thickness of the processing liquid influenced by temperature can be made into homogeneity.

[0041] According to claim 20, said migration process in claim 15 passes along the center section of a substrate from the 1st periphery of a substrate. With said 1st periphery to the 2nd periphery of an opposite hand It is also moving a nozzle along the direction of a path. Said substrate from said 1st periphery to said center section [said revolution process] While moving, said substrate is rotated in

the 1st direction, and while said substrate moves from said center section to said 2nd periphery, the film formation approach characterized by rotating said substrate in the 2nd direction of an opposite direction with said 1st direction is offered.
[0042] Thus, the locus on the substrate of the processing liquid supplied while moving from said 1st periphery to the center section of a substrate, and the locus of the processing liquid supplied while moving from the center section of a substrate to the 2nd periphery are in agreement by reversing a revolution of a substrate in the migration process of a nozzle. Consequently, the spots of the processing liquid on a substrate decrease further, and the uniform film is formed.
[0043] Moreover, you may make it have further the process to which said control activation process in claims 15-20 mentioned above is made to carry out preferentially according to claim 21. Thus, by making it make said control activation process perform preferentially, it is not influenced by other activation processes but the activation process of migration of a nozzle or the roll control of a substrate can be performed to exact timing. Therefore, migration of said nozzle and a revolution of a substrate are controlled strictly, and the uniform film is formed on a substrate.
[0044] In the approach of forming the film of processing liquid on a substrate according to claim 22 Said substrate The process to rotate, Said processing liquid which supplied said processing liquid breathed out from the 1st nozzle to the 1st field from the center section of said rotating substrate to the range of a predetermined radius of gyration, and was breathed out from the 2nd nozzle to the 2nd field from said predetermined radius of gyration to the range of the periphery of the substrate outside said predetermined radius of gyration So that the processing liquid to which the process to supply, and said the 1st nozzle and 2nd nozzle are simultaneously supplied the process of said rotating substrate which moves in the direction of a path mostly, and on said substrate may become homogeneity The film formation approach characterized by providing the process which performs one control of the passing speed of the rotational speed of said substrate, the amount of supply of said processing liquid or said 1st nozzle, and the 2nd nozzle at least is offered.
[0045] Since according to claim 22 move simultaneously in a substrate top, the field on the substrate with which two nozzles were shared with each nozzle, i.e., the 1st nozzle, supplies the field from the center section of a substrate to a predetermined radius of gyration to coincidence and the 2nd nozzle supplies processing liquid to the field from said predetermined radius of gyration to the periphery section of a substrate respectively, the duration which will start before the film of processing liquid is formed on a substrate can be shortened. Moreover, the passing speed of the rotational speed of a substrate, the amount of supply of processing liquid or said 1st nozzle, and the 2nd nozzle is controlled to it and coincidence, and the film of uniform processing liquid can be formed in a substrate side.
[0046] Furthermore, in the film formation approach of claim 22, like claim 23, said 1st nozzle is turned to said predetermined radius of gyration from the center section of said substrate, and it moves, and said migration process turns said 2nd nozzle to said predetermined radius of gyration from the periphery of said substrate, moves, and may be made to be performed. Thus, by making in agreement the migration direction of the 1st nozzle and the 2nd nozzle, both can be attached in the same driving shaft and processing liquid can be suitably supplied all over a substrate only by moving the driving shaft. Consequently, when two nozzles are prepared, the migration device of a nozzle is simplified, and film formation of processing liquid is carried out suitably.
[0047]
[Embodiment of the Invention] Spreading processing equipment equipped with the resist spreading processing unit for enforcing the resist film formation approach concerning the gestalt of operation of this invention hereafter is explained. Drawing 1 -3 show the appearance of spreading processing equipment, and drawing 1 is [a front view and drawing 3 of a top view and drawing 2] rear view.
[0048] spreading processing equipment 1 with the cassette station 2 for carrying out carrying-in appearance of the 25 wafers W from the exterior to spreading processing equipment 1 per cassette, or carrying out carrying-in appearance of the wafer W to a cassette, as shown in drawing 1 The processing station 3 which comes to carry out multistage arrangement of the various processing units which perform predetermined processing to single wafer processing in a spreading development process, It has the configuration which connected to one the interface section 5 for delivering Wafer W between the aligners (not shown) adjoined and formed in this processing station 3.

[0049] At the cassette station 2, two or more cassettes 7 can turn the gate of Wafer W to the processing station 3 side, and can lay in the direction (vertical direction in drawing 1) single tier of X freely at the position on the cassette installation base 6. And the movable wafer conveyance object 8 can move in the wafer array direction (Z direction; perpendicular direction) of the wafer W held in this cassette array direction (direction of X) and cassette 7 freely along the conveyance way 9, and it can access now selectively to a cassette 7.
[0050] The wafer conveyance object 8 is constituted free [a revolution] also in the direction (hand of cut centering on the Z-axis) of theta, and it is constituted so that it can access also to the alignment unit 32 and the extension unit 33 which belong to 3rd processor group G3 by the side of the processing station 3 so that it may mention later.
[0051] The main transport device 13 equipped with three pincettes 10, 11, and 12 holding Wafer W under Kaminaka is arranged in the core, around the main transport device 13, various processing units are arranged multistage, and the processor group consists of processing stations 3. In spreading processing equipment 1, four processor groups G1 and G2, G3, and G4 can be arranged. The 1st and 2nd processor groups G1 and G2 are arranged at the transverse-plane side of spreading processing equipment 1, 3rd processor group G3 adjoins the cassette station 2, and is arranged, and the 4th processor group G4 adjoins the interface section 5, and is arranged. Moreover, the 5th processor group G5 can also be arranged to a tooth-back side if needed.
[0052] By the 1st processor group G1, as shown in drawing 2 , two kinds of spinner mold processing units 15, for example, the resist spreading processing unit which applies and processes resist liquid to Wafer W, and the development unit 16 which supplies and processes a developer to Wafer W are arranged sequentially from the bottom in two steps. By the 2nd processor group G2, the resist spreading processing unit 15, the resist spreading processing unit 17 which has the same configuration fundamentally, and the development unit 16 and the development unit 18 which has the same configuration fundamentally are accumulated on two steps sequentially from the bottom.
[0053] As 3rd processor group G3 shows to drawing 3 , Wafer W It puts on an installation base. Predetermined processing The processing unit of the oven mold to give, for example, cooling processing Fixable [of the cooling unit 30, and the resist and Wafer W to perform] The alignment of the adhesion unit 31 to raise and Wafer W The post baking unit 36 and 37 grades which perform heat-treatment after the alignment unit 32 to perform, the extension unit 33 which makes Wafer W stand by, the PURIBE king units 34 and 35 which perform heat-treatment before exposure processing, and a development have put on eight steps sequentially from the bottom.
[0054] By the 4th processor group G4, the cooling unit 40, the extension cooling unit 41 which makes the laid wafer W cool naturally, the extension unit 42, the cooling unit 43, the postexposure baking units 44 and 45 that perform heat-treatment after exposure processing, the post baking unit 46, and 47 grades are accumulated on eight steps sequentially from the bottom, for example.
[0055] The interface section 5 is equipped with the circumference aligner 51 which exposes the periphery of Wafer W, and the wafer conveyance object 52. The wafer conveyance object 52 is formed so that migration of the direction of X (the vertical direction in drawing 1) and a Z direction (perpendicular direction) and a revolution of the direction (hand of cut centering on the Z-axis) of theta may become respectively free, and it can be accessed now to an aligner (not shown), the extension cooling unit 41, the extension unit 42, and the circumference aligner 51, respectively.
[0056] Spreading processing equipment 1 is constituted as mentioned above. Next, the configuration of the resist spreading processing unit 15 for enforcing the resist film formation approach concerning the gestalt of operation of this invention is explained.
[0057] The resist spreading processing unit 15 has the cup 55 which can hold Wafer W freely in casing 15a, as shown in drawing 4 , and in this cup 55, it has the spin chuck 56 which holds horizontally the wafer W which carried out vacuum adsorption, and the motor 57 made to rotate a spin chuck 56. The rotational frequency of a motor 57 is controlled to become the rotational frequency of arbitration with a control unit 58, and, thereby, Wafer W is pivotable at the rotational frequency of arbitration.
[0058] In the cup 55 upper part, it has a resist liquid supply means 60 to apply resist liquid to Wafer W, and a solvent supply means 65 to supply the solvent (henceforth a "solvent") of resist liquid to Wafer W.

[0059] The resist liquid supply means 60 has the resist liquid tank 61 which supplies resist liquid, the resist liquid regurgitation nozzle N1 which carries out the regurgitation of the resist liquid to Wafer W, and the resist liquid supply tube 62 with which the resist liquid supplied from the resist liquid tank 61 circulates, and the pumps 63, such as a bellows pump and a diaphragm mold pump, and a filter 64 are infixed in the resist liquid supply tube 62 from the upstream, for example.
[0060] The solvent supply means 65 has the solvent tank 66 which supplies a solvent, the solvent regurgitation nozzle S1 which carries out the regurgitation of the solvent to Wafer W, and the solvent supply tube 67 with which the solvent supplied from the solvent tank 66 circulates, and the pump 68 is infixed in the solvent supply tube 67.
[0061] It is held at the nozzle holder 70 with common resist liquid regurgitation nozzle N1 and solvent regurgitation nozzle S1, and the outward trips 71a and 72a and return trips 71b and 72b which were constituted with the tube through which a temperature tone rectification object, for example, a temperature pondage etc., circulates are prepared in the nozzle holder 70. While the temperature control of the resist liquid which circulates the resist liquid supply tube 62 is carried out to predetermined temperature by the temperature pondage which circulates through outward trip 71a and return trip 71b, the temperature control of the solvent which circulates the solvent supply tube 67 is carried out to predetermined temperature by the temperature pondage which circulates through outward trip 72a and return trip 72b.
[0062] And as the above-mentioned nozzle holder 70 is shown in drawing 5 , it is held inside the maintenance device 73 arranged on the outside of a cup 55, and the maintenance device 73 is further equipped with a nozzle holder 70 and the nozzle holders 74, 75, and 76 which have the same configuration fundamentally. As for these nozzle holders 74, 75, and 76, it is possible to make the resist liquid from the resist liquid tank (not shown) which made the group the resist liquid regurgitation nozzles N2-N4 and the solvent regurgitation nozzle S2 - S4, respectively, held them, and became independent respectively breathe out from the resist liquid regurgitation nozzles N2-N4 which correspond respectively. Therefore, if it is in the gestalt of this operation, it is possible to supply four kinds of different resist liquid to Wafer W.
[0063] The diameter of the discharge opening of the resist liquid regurgitation nozzles N2-N4 had the desirable range of 10 micrometers - 500 micrometers, and about 135 micrometers was suitable for it. It is because the flow rate of resist liquid will decrease too much if smaller than 10 micrometers, and is because liquid drips and falls from a resist liquid regurgitation nozzle and control of a flow rate becomes impossible, when larger than 500 micrometers. Moreover, when the classes of resist liquid differ, as for the diameter of the discharge opening of the resist liquid regurgitation nozzles N2-N4, it is desirable to change according to the viscosity of each resist liquid. For example, it is more desirable to enlarge said diameter more compared with the case where the viscosity of resist liquid is low, when the viscosity of resist liquid is high.
[0064] Retaining pins 77, 78, 79, and 80 are formed in nozzle holders 70, 74, 75, and 76, respectively, and these retaining pins 77, 78, 79, and 80 are held by the scanning arm 82 of the scanning device 81. The scanning arm 82 is constituted so that it may become movable to the three-dimensions migration of X, i.e., the direction, the direction of Y, and a Z direction, and the passing speed of the scanning arm 82 is suitably controlled by said control unit 58. Therefore, three-dimensions migration by the scanning device 81 is free for nozzle holders 70, 74, 75, and 76, and the passing speed in that case is suitably controlled by the control unit 58.
[0065] The resist spreading processing unit 15 is constituted as mentioned above. Next, the resist film formation approach concerning the gestalt of operation of this invention is explained.
[0066] After the wafer W which predetermined heat-treatment ended in the PURIBE king unit 34 is conveyed by the resist spreading processing unit 15, adsorption maintenance of it is carried out on a spin chuck 56. And the resist liquid to be used is chosen and the scanning arm 82 goes the nozzle holder equipped with the resist liquid regurgitation nozzle NX in which the regurgitation [this selected resist liquid] is possible picking. If the resist liquid regurgitation nozzle N1 is chosen in this case, the scanning arm 82 will go a nozzle holder 70 picking.
[0067] And a nozzle holder 70 stops in the predetermined location of the cup 55 upper part in the condition of having been held at the scanning arm 82, and a solvent is first breathed out from the solvent regurgitation nozzle S1 to the center section of Wafer W. By revolution of Wafer W, the

breathed-out solvent is diffused on the front face of the wafer W concerned.
[0068] Subsequently, after moving a nozzle holder 70 to the periphery of Wafer W, Wafer W is rotated, uniform migration of the nozzle holder 70 is carried out along the direction of a path of Wafer W according to the scanning device 81, and as shown in drawing 6 and 7, uniform migration of the resist liquid regurgitation nozzle N1 is carried out from the periphery B of Wafer W to the center section C of Wafer W. And although resist liquid is made to breathe out from the resist liquid regurgitation nozzle N1 to Wafer W between migration in the center section C of the wafer W of this resist liquid regurgitation nozzle N1, i.e., migration in the direction of a path, that discharge quantity is gradually decreased as the resist liquid regurgitation nozzle N1 moves to a center section C from Periphery B. In addition, the change in the resist liquid discharge quantity from the resist liquid regurgitation nozzle N1 can be performed by making the amount of liquid sending of the resist liquid from a pump 63 fluctuate. For example, in the case of a bellows pump or a diaphragm mold pump, the pump 63 is controlling the amount of pushing by the stepping motor, but the amount of liquid sending of the resist liquid from a pump 63 can be decreased by lowering the pulse dispatch value to this stepping motor at any time.
[0069] If it does so, the resist liquid breathed out from the resist liquid regurgitation nozzle N1 will be applied drawing a spiral locus, as shown in drawing 8 . And since resist liquid discharge quantity is applied to a center section C and is gradually decreased from Periphery B, the resist liquid amount of supply per [which is supplied to Periphery B and a center section C] unit area can be made equal. Moreover, since resist liquid is applied drawing a spiral locus, even if resist liquid is not applied to homogeneity to a substrate at the beginning of spreading, the applied resist liquid comes to spread on Wafer W after that at homogeneity by the fluidity of resist liquid and the revolution of Wafer W which were applied. Consequently, even if it carries out the high-speed revolution of the wafer W and does not diffuse resist liquid with a centrifugal force to the periphery of Wafer W, as shown in drawing 9 , the uniform resist film can be formed on Wafer W. Moreover, since the high-speed revolution of the wafer W is not carried out, scattering of resist liquid can also be prevented.
[0070] Furthermore, from Periphery B to a center section C, as shown in drawing 10 and 11, as it is, to Periphery A, it extends and uniform migration of the resist liquid regurgitation nozzle N1 which carried out uniform migration is carried out, and you may make it make the discharge quantity of resist liquid to Wafer W increase gradually during the uniform migration from the center section C of the resist liquid regurgitation nozzle N1 to Periphery A.
[0071] If it does so, in case the resist liquid regurgitation nozzle N1 will carry out uniform migration from a center section C to Periphery A, resist liquid is applied drawing a spiral locus on the rotating wafer W. Therefore, since resist liquid will be spirally applied twice [a total of] to Wafer W while moving from a center section C to Periphery A while the resist liquid regurgitation nozzle N1 carries out uniform migration from Periphery B to a center section C, spreading nonuniformity of resist liquid can be made still fewer than the above-mentioned case.
[0072] And since the resist liquid amount of supply is gradually made [many] while the resist liquid regurgitation nozzle N1 moves from a center section C to Periphery A, resist liquid coverage per unit area can be ana carried out between a center section C and Periphery A also in this case. Consequently, the uniform resist film can be formed on Wafer W.
[0073] By in addition, the thing for which the hand of cut of Wafer W is reversed while moving from a center section C to Periphery A while the resist liquid regurgitation nozzle N1 moves from Periphery B to a center section C It can be made in agreement like the locus which showed the locus of the resist liquid on the wafer W in the case of moving from the locus and center section C of resist liquid on the wafer W in case the resist liquid regurgitation nozzle N1 moves from Periphery B to a center section C to Periphery A to drawing 8 . Consequently, the uniform resist film can be formed on Wafer W.
[0074] Although the point of resist liquid regurgitation initiation was set as Periphery B and the nozzle holder 70 was moved on the diameter of the straight-line top W, i.e., a wafer, through the center section C with the gestalt of said operation to the periphery A which is the regurgitation halt point of resist liquid as shown in drawing 11 As it replaces with this and is shown in drawing 12 , periphery A' which is the regurgitation halt point of resist liquid may be set as the point which is not on the diameter of Wafer W, and a nozzle holder 70 may be moved. Moreover, a regurgitation

initiation point and a regurgitation halt point may be set as the same point. That is, both-way migration of the resist liquid regurgitation nozzle N1 is carried out at uniform velocity between Periphery B and a center section C, resist liquid coverage is gradually lessened on an outward trip, and it may be made to make [many] resist liquid coverage gradually in a return trip.
[0075] Moreover, although the example which started the regurgitation of resist liquid from Periphery B was explained if it was in the gestalt of said operation, the point of resist liquid regurgitation initiation is set as a center section C, uniform migration of the resist liquid regurgitation nozzle N1 is carried out from a center section C to Periphery A, and you may make it increase gradually the resist liquid discharge quantity from the resist liquid regurgitation nozzle N1 during this migration, as shown in drawing 13 .
[0076] Since the regurgitation of the resist liquid is carried out to the wafer W which rotates from the resist liquid regurgitation nozzle N1 which carries out uniform migration also in this case, resist liquid can be applied on Wafer W, as a spiral locus is drawn. And since it applies to Periphery A from a center section C and resist liquid discharge quantity is made to increase gradually, even if it can carry out the resist liquid amount of supply per unit area ana on the whole front face of Wafer W, it carries out the high-speed revolution of the wafer W and it does not diffuse resist liquid with a centrifugal force not to mention Periphery A and a center section C, the uniform resist film can be formed on Wafer W. Moreover, desiccation of resist liquid can be equalized more by beginning especially supply of resist liquid from the core C of Wafer W.
[0077] While carrying out uniform migration of the resist liquid regurgitation nozzle N1 to a center section C by return by Periphery A as shown in drawing 14 after carrying out still like drawing 13 and supplying resist liquid to Wafer W, it may be made to lessen the amount of supply of the resist liquid supplied during this migration at Wafer W gradually. In this case, since resist liquid can be applied twice on Wafer W as a spiral locus is drawn, spreading nonuniformity of resist liquid can be lessened further.
[0078] Although the example which carries out uniform migration of the nozzle holder 70, and changes the resist liquid discharge quantity from the resist liquid regurgitation nozzle N1 during the migration was given and explained if it was furthermore in the gestalt of said operation As shown not only in this but in drawing 15 , acceleration migration of the nozzle holder 70 is carried out from Periphery B up to a center section C along the direction of a path of Wafer W, and you may make it a center section C to the periphery B apply resist liquid to the rotating wafer W in this invention, carrying out slowdown migration.
[0079] That is, if resist liquid is applied setting the point of resist liquid regurgitation initiation as Periphery B, and carrying out acceleration migration of the resist liquid regurgitation nozzle N1 from Periphery B to a center section C, as shown in drawing 16 , resist liquid can be applied on Wafer W like the time of the above-mentioned operation gestalt, as a spiral locus is drawn. And since it was made to become quick gradually, applying [of the resist liquid regurgitation nozzle N1] it to a center section C from Periphery B, it decreases gradually from Periphery B, resist liquid applying it to a center section C. Therefore, the resist liquid amount of supply per unit area can be similarly carried out ana to the whole front face of Wafer W also in this case.
[0080] And if it applies setting the point of a resist liquid regurgitation halt as Periphery A, and carrying out slowdown migration of the resist liquid regurgitation nozzle N1 from a center section C to Periphery A succeedingly, as shown in drawing 17 from this condition, resist liquid can be again applied on Wafer W, as a spiral locus is drawn. And since it was made to become late gradually, applying [of the resist liquid regurgitation nozzle N1] it to Periphery A from a center section C, it increases gradually from a center section C, resist liquid applying it to Periphery A. Therefore, resist liquid discharge quantity per [to the whole front face of Wafer W] unit area can be similarly carried out ana also in this case.
[0081] The uniform resist film can be formed on the wafer W concerned also by acceleration of such a resist liquid regurgitation nozzle N1, and slowdown migration, without carrying out the high-speed revolution of the wafer W like before. It also becomes possible to attain simultaneously reduction-ization of the resist liquid which loses and uses the futility by scattering of resist liquid.
[0082] Thus, as shown in drawing 18 , the point of resist liquid regurgitation initiation is set as a center section C, the point of a resist liquid regurgitation halt is set as Periphery A, respectively, and

it applies to Periphery A from a center section C, and may be made to accelerate the passing speed of the resist liquid regurgitation nozzle N1, and to make late passing speed of the resist liquid regurgitation nozzle N1, even when carrying out slowdown migration gradually.
[0083] You may make it apply resist liquid, turning up the resist liquid regurgitation nozzle N1 by Periphery A, applying to the center section C which is the point of a resist liquid regurgitation halt from this periphery A, and carrying out acceleration migration of the resist liquid regurgitation nozzle N1 gradually, as furthermore shown in drawing 19 from this condition.
[0084] Although the case where rotational speed applied resist liquid to the fixed wafer W was mentioned as the example and explained if it was in the gestalt of said operation, the engine speed per unit time amount of a spin chuck 56, i.e., the rotational speed of a spin chuck 56, is controlled by this invention, and you may make it change the rotational speed of Wafer W. That is, it may be made to make gradually late rotational speed of the wafer W at the time of making gradually quick rotational speed of the wafer W when the resist liquid regurgitation nozzle N1 being missing from a center section C from the periphery B of a resist liquid regurgitation initiation point, and moving, as shown, for example in drawing 20 , making it the highest rotational speed in a center section C, and the resist liquid regurgitation nozzle N1 being missing from Periphery A from a center section C, and moving.
[0085] Thus, if the rotational speed of Wafer W is also changed further in addition to the adjustment of the resist liquid amount of supply and the adjustment of the passing speed of the resist liquid regurgitation nozzle N1 which were mentioned above, the rotation distance of Wafer W will change, it will face forming the uniform resist film on Wafer W, and finer adjustment can be performed.
[0086] Moreover, as shown in drawing 21 , a pump 63 is minded from the resist liquid tank 61 of the resist liquid supply means 60. The supplied resist liquid and the solvent supplied through the pump 102 from the solvent tank 101 in which solvents, such as thinner, were stored by the mixer 103 So that the viscosity of the resist liquid which is mixed, changes according to migration of the resist liquid regurgitation nozzle N1, the amount of supply of mixing, i.e., amount, of a solvent from this solvent tank 101, and is applied on Wafer W may be changed You may carry out, it faces forming the uniform resist film on Wafer W also in this case, and finer adjustment is possible. When a control unit 58 drives a pump 63,102 in this case, the amount of mixing is changeable.
[0087] Furthermore, the rotational speed of the wafer W at the time of the resist liquid regurgitation nozzle N1 moving from Periphery B to the periphery A it is [periphery] a resist liquid regurgitation halt point may be controlled to be shown in drawing 22 . That is, for example, the resist liquid regurgitation nozzle N1 is made to reach full speed in the point D between Periphery B and a center section C, it maintains until it moves the rotational speed at this time to a center section C from Point D, and it may be made to make late rotational speed of the wafer W at the time of the resist liquid regurgitation nozzle N1 moving from a center section C to Periphery A after that gradually.
[0088] If an example of rotational-speed control of such a wafer W is explained based on drawing 23 and 24, drawing 23 shows each shunts E, F, G, H, J, and K on the wafer W of the resist liquid regurgitation nozzle N1, and drawing 24 shows the passing speed of the resist liquid regurgitation nozzle N1 in each shunt. In this example, the resist liquid of a constant rate is breathed out from the resist liquid regurgitation nozzle N1 to Wafer W from the center section C which is a resist liquid regurgitation initiation point to the periphery A which is a resist liquid regurgitation halt point, making it decrease functionally the passing speed of a nozzle, and the rotational speed of Wafer W the 2nd order to the distance which the resist liquid regurgitation nozzle N1 moved. Thus, even if it controls the rotational speed of Wafer W to the passing speed and coincidence of the resist liquid regurgitation nozzle N1, applying the resist liquid of a constant rate to Wafer W, the coverage of the resist liquid per [to Wafer W] unit area becomes fixed, and can form the uniform resist film on Wafer W.
[0089] And in order to enforce more suitably the resist film formation approach concerning the gestalt of said the operation of each, when it has the acceptance member 90 shown in the resist spreading processing unit 15 at drawing 25 , in addition, it is desirable.
[0090] As this acceptance member 90 is shown in drawing 25 , it is formed in the configuration which can catch the resist liquid breathed out from the resist liquid regurgitation nozzle N1 to Wafer W, and this acceptance member 90 is supported by actuation of a motor (not shown) etc. by the

migration member 91 which can move in the die-length direction of said scanning arm 82 freely. And the acceptance member 90 is constituted free [migration] along the die-length direction of said scanning arm 82 in between the positions in readiness shown by migration of the migration member 91 with the predetermined location shown as the continuous line of this drawing located in the vertical lower part of the resist liquid regurgitation nozzle N1, and a dashed line.

[0091] And when carrying out the approach of setting the point of resist-liquid regurgitation initiation as a center section C, setting the point of a resist-liquid regurgitation halt as Periphery A, respectively, for example, applying from a center section C to Periphery A, and carrying out slowdown migration of the resist-liquid regurgitation nozzle N1 gradually according to the resist spreading processing unit 15 equipped with the acceptance member 90 which has the above configurations, as it is shown to drawing 26 -28, an acceptance member 90 moves, and regurgitation initiation of resist liquid and a halt control.

[0092] That is, as the resist liquid regurgitation nozzle N1 shows as the continuous line of drawing 26 first, when carrying out acceleration migration to the location of the center section C shown according to the two-dot chain line of this drawing from Periphery B, the acceptance member 90 is in a predetermined location, and the resist liquid breathed out from the resist liquid regurgitation nozzle N1 is caught by the acceptance member 90. Therefore, the resist liquid breathed out from the resist liquid regurgitation nozzle N1 during this migration is not supplied to Wafer W.

[0093] Subsequently, when the resist liquid regurgitation nozzle N1 passes through a center section C, it is made to move to the position in readiness which shows the acceptance member 90 as the continuous line of this drawing from the predetermined location shown with the dashed line of this drawing, as shown in drawing 27 . The resist liquid breathed out from the resist liquid regurgitation nozzle N1 is no longer caught by the acceptance member 90, and is applied as it is to Wafer W by this.

[0094] Then, after applying resist liquid to Wafer W and completing spreading of resist liquid to Periphery A, carrying out slowdown migration of the resist liquid regurgitation nozzle N1 from a center section C to Periphery A, as shown in drawing 28 , the resist liquid which is made to move the acceptance member 90 to a predetermined location, and is breathed out from the resist liquid regurgitation nozzle N1 is again caught by the acceptance member 90.

[0095] According to this acceptance member 90, by moving the acceptance member 90 between a position in readiness and a predetermined location, spreading of the resist liquid to Wafer W can be started in an instant in the condition of having made resist liquid breathing out from the resist liquid regurgitation nozzle N1, or spreading of the resist liquid to Wafer W can be conversely suspended now in an instant. That is, the direction to which the acceptance member 90 was moved in this way than the case where initiation and a halt of resist liquid spreading are controlled by the pump 63 which sends resist liquid to the resist liquid regurgitation nozzle N1 can raise the responsibility of resist liquid spreading to Wafer W conventionally. So, it faces enforcing the resist film formation approach mentioned above in the resist spreading processing unit 15 equipped with the acceptance member 90, halt of resist liquid spreading in the periphery A of Wafer W and initiation of resist liquid spreading in the center section C of Wafer W can be performed promptly, and suitable resist film formation is attained rather than before.

[0096] Moreover, since the resist liquid caught by the acceptance member 90 is reusable, the resist liquid which is needed at the time of resist spreading processing of Wafer W is effectively [without futility] utilizable. If the resist spreading processing unit 15 equipped with such an acceptance member 90 is used, the resist film formation approach concerning this invention can be enforced suitably.

[0097] Next, the gestalt of the further operation of this invention is explained. As shown in drawing 29 , with the gestalt of this operation, the 1st resist liquid regurgitation nozzle N11 and the 2nd resist liquid regurgitation nozzle N12 are used as a resist liquid regurgitation nozzle.

[0098] Adsorption maintenance is carried out by the spin chuck 56, and Wafer W rotates by it. Above Wafer W, the 1st above-mentioned resist liquid regurgitation nozzle N11 and the 2nd resist liquid regurgitation nozzle N12 are arranged. The 1st resist liquid regurgitation nozzle N11 and the 2nd resist liquid regurgitation nozzle N12 are made movable [in the direction of a path of Wafer W] similarly by the common drive system 111. In addition, the 1st resist liquid regurgitation nozzle N11

and the 2nd resist liquid regurgitation nozzle N12 may be formed in a respectively separate drive system.
[0099] The 1st resist liquid regurgitation nozzle N11 is used in order to supply resist liquid to the 1st field 112 from the center section C of the rotating wafer W to the range of the predetermined radius of gyration X. The 2nd resist liquid regurgitation nozzle N12 is used in order to supply resist liquid to the 2nd field 113 from the predetermined radius of gyration X to the range of the periphery B of the wafer W outside the predetermined radius of gyration X.
[0100] And in an initial state, the 1st resist liquid regurgitation nozzle N11 is located in the center section C of Wafer W, and the 2nd resist liquid regurgitation nozzle N12 is located in the periphery B of Wafer W. The regurgitation of resist liquid is started on Wafer W from each of this condition to the 1st resist liquid regurgitation nozzle N11 and the 2nd resist liquid regurgitation nozzle N12. By the drive system 111 The 1st resist liquid regurgitation nozzle N11 And the direction N11 of a path of Wafer W, i.e., the 1st resist liquid regurgitation nozzle, is moved in the predetermined radius-of-gyration X direction from the center section C of Wafer W, and the 2nd resist liquid regurgitation nozzle N12 is moved in the predetermined radius-of-gyration X direction for the 2nd resist liquid regurgitation nozzle N12 from the periphery B of Wafer W. It is gradually increased by the resist liquid breathed out from the 1st resist liquid regurgitation nozzle N11 in the case of this migration, and the resist liquid breathed out from the 2nd resist liquid regurgitation nozzle N12 decreases in number gradually, and he is trying for the resist liquid supplied on Wafer W by this to become homogeneity.
[0101] With the gestalt of this operation, shortening of the processing time for supplying resist liquid can be attained by having two or more nozzles especially.
[0102] Next, the gestalt of still more nearly another operation of this invention is explained. With the gestalt of this operation, as shown in drawing 30 , the adjustable device 121 which carries out adjustable [of the include angle of resist liquid regurgitation nozzle N' and this resist liquid regurgitation nozzle N', and Wafer W to make] is arranged above the wafer W C in which was pivotable and adsorption maintenance was carried out by the spin chuck 56, for example, a center section.
[0103] And in case resist liquid is supplied on Wafer W, the wafer W up location of the resist liquid supplied from resist liquid regurgitation nozzle N' is moved to Periphery B from the center section C which is the rotating wafer W by carrying out adjustable [of the include angle with Wafer W to make] to resist liquid regurgitation nozzle N'.
[0104] Especially with the gestalt of this operation, the configuration of a drive (adjustable device 121) can be used more as a compact.
[0105] Next, the gestalt of the further operation of this invention is explained. With the gestalt of this operation, as shown in drawing 31 and drawing 32 , in case resist liquid is supplied to Wafer W within the resist spreading processing unit 15, it is made to carry out the regurgitation of the resist liquid for Wafer W top from the resist liquid regurgitation nozzle N1 with covering 131 to Wafer W with a bonnet.
[0106] Cooling means, such as a Peltier device, are established in covering 131 here, and it is controlled so that the ambient atmosphere between Wafer W and covering 131 serves as predetermined temperature by this. Thus, with constituting so that resist liquid may be supplied to Wafer W in the ambient atmosphere by which temperature control was carried out, thickness of the resist liquid applied to Wafer W can be made more into homogeneity.
[0107] Moreover, the slot 132 is formed in the direction of a path of Wafer W so that supply of resist liquid may be possible for the resist liquid regurgitation nozzle N1 to Wafer W to covering 131. In order to perform such ambient atmosphere control, a cooling means may be established for example, in a spin chuck 56.
[0108] Moreover, although exhaust air is usually continuously performed in the resist spreading processing unit 15, in the case of supply of the above-mentioned resist liquid, the above-mentioned ambient atmosphere control can be more effectively performed by once stopping exhaust air.
[0109] By the way, although it indicated with it also when both the passing speed of a nozzle and the rotational speed of Wafer W were controlled by the gestalt of the first operation mentioned above, it is necessary to control migration of a nozzle, and a revolution of Wafer W by exact timing in that

case. With the gestalt of the following operations, it is an example of a system for performing such control.
[0110] Drawing 33 is the example of a configuration of the control system of the spreading processing equipment 1 shown in drawing 1 . As shown in drawing 33 , in this control system, it has the composition that two or more sub control sections 142a, 142b, and 142c were connected to the main control section 141. For example, sub control section 142a controls one resist spreading processing unit 15, sub control section 142b controls the development unit 16, and sub control section 142c controls the main transport device 13. Each other units are also controlled by the sub control section which became independent similarly. The main control section 141 controls these sub control section in the gross. The main control section 141 controls conveyance of the wafer W by the main transport device 13 by predetermined timing, on the other hand, actuation by the resist spreading processing unit 15 is controlled, this delivers Wafer W to the resist spreading processing unit 15 from the main transport device 13, for example, and supply of the resist liquid to Wafer W is performed. Such control is performed by publishing an instruction in each sub control section from the main control section 141.
[0111] It is necessary to control as follows the migration of the resist liquid regurgitation nozzle N1 and the revolution of a spin chuck 56 in the gestalt of operation shown first, for example.
When migration of the resist liquid regurgitation nozzle N1 and the revolution of a spin chuck 56 are started and the passing speed of (2) resist-liquid regurgitation nozzle N1 reaches 40rpm in 35 mm/sec, the rotational speed of a spin chuck 56 (1) Within 10 msecs (3) While starting the regurgitation of the resist liquid from the resist liquid regurgitation nozzle N1 The passing speed of the resist liquid regurgitation nozzle N1 is slowed down from 35 mm/sec to 20 mm/sec, and after reaching this rate, the rotational speed of the (4) spin chuck 56 is slowed down from 40rpm to 25rpm within 10 msecs. (5) If the resist liquid regurgitation nozzle N1 moves to the periphery of Wafer W, migration of the resist liquid regurgitation nozzle N1 and the revolution of a spin chuck 56 will be stopped.
[0112] Here, as shown in drawing 34 , it judges whether the main control section 141 is the instruction (for example, above-mentioned (1) - (5)) relevant to migration of the resist liquid regurgitation nozzle N1, and the revolution of a spin chuck 56 in the instruction, if an instruction is published by each sub control section (step 3301) (step 3302). And when it is the instruction relevant to migration of the resist liquid regurgitation nozzle N1, and the revolution of a spin chuck 56, priority is made to give over other instructions (step 3303), and an instruction is transmitted to the sub control section (step 3304).
[0113] Since priority is given to the instruction relevant to migration of the resist liquid regurgitation nozzle N1, and the revolution of a spin chuck 56 in this way and he is trying to transmit according to the gestalt of this operation, it becomes possible to control migration of a nozzle, and a revolution of Wafer W by exact timing.
[0114] Although the gestalt of said operation gave and explained the example which forms the resist film on Wafer W, also when forming the film of other processing liquid, for example, an interlayer insulation film, the polyimide film, the ferroelectric ingredient film, etc. on Wafer W, it can apply by this invention. This invention is especially suitable [0115] for the thick thing of thickness like an interlayer insulation film. Moreover, although the example which uses Wafer W as a substrate was given and explained, this invention can be applied also when using other substrates, such as for example, a LCD substrate and CD substrate.
[0116]
[Effect of the Invention] Without rotating a substrate at high speed, the processing liquid amount of supply per [to the whole front face of a substrate] unit area can be ****ed ana, and the film of uniform processing liquid can be formed in claims 1-13, and 15-23 on the substrate concerned. Therefore, while processing liquid does not disperse from a substrate but attaining reduction-ization of processing liquid, contamination with the processing liquid which dispersed can also be prevented.
[0117] In claim 9, since the rotational speed of a substrate was also controlled besides adjustment of the processing liquid amount of supply [especially as opposed to the periphery and center section of a substrate], or the passing speed of a nozzle, it faces forming the film of processing liquid on a

substrate, and more detailed adjustment is attained.
[0118] In claim 10, by repeating migration of the nozzle which met in the direction of a path of a substrate, and performing it, the supply nonuniformity of processing liquid disappears from on a substrate, and the film of uniform processing liquid can be formed more certainly.
[0119] In claim 11, since the viscosity of processing liquid was also controlled besides adjustment of the processing liquid amount of supply to the periphery and center section of a substrate, or the passing speed of a nozzle, it faces forming the film of processing liquid on a substrate, and more detailed adjustment is attained.
[0120] Since it was made to receive the processing liquid breathed out from the nozzle by the acceptance member according to claim 14, the supply initiation and supply interruption of processing liquid to a substrate can be promptly performed rather than before. That is, supply initiation of processing liquid and the responsibility of supply interruption improve conventionally. Moreover, since the processing liquid which the acceptance member has received is reusable, the processing liquid received by this acceptance member can be used effectively.

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the rough top view of spreading processing equipment equipped with the resist spreading processing unit for enforcing the resist film formation approach concerning the gestalt of operation of this invention.
[Drawing 2] It is the front view of the spreading processing equipment of drawing 1 .
[Drawing 3] It is the rear view of the spreading processing equipment of drawing 1 . .
[Drawing 4] It is the rough explanatory view of the resist spreading processing unit for enforcing the resist film formation approach concerning the gestalt of this operation.
[Drawing 5] It is the top view of the resist spreading processing unit of drawing 4 .
[Drawing 6] The resist liquid regurgitation nozzle of the resist spreading processing unit of drawing 4 is the explanatory view showing signs that it moves from the periphery of a wafer to a center section.
[Drawing 7] It is the explanatory view showing signs that the condition of drawing 6 was seen from the flat surface.
[Drawing 8] It is the explanatory view showing signs that resist liquid was applied from the resist liquid regurgitation nozzle of drawing 6 to the wafer.
[Drawing 9] It is the cross-section explanatory view which looked at the wafer with which the resist liquid of drawing 8 was applied from the side face.
[Drawing 10] It is the explanatory view showing signs that a resist liquid regurgitation nozzle is further moved from the condition of drawing 6 to the periphery on the diameter of a wafer.
[Drawing 11] It is the explanatory view showing signs that the condition of drawing 10 was seen from the flat surface.
[Drawing 12] It is the explanatory view which looked at signs that a resist liquid regurgitation nozzle was moved from the condition of drawing 6 to the periphery which is not on the diameter of a wafer, from the flat surface.
[Drawing 13] It is the explanatory view showing the locus of the resist liquid regurgitation nozzle at the time of setting the regurgitation initiation point of resist liquid as the center section of a wafer, and setting the regurgitation halt point of resist liquid as the periphery of a wafer, respectively.
[Drawing 14] It is the explanatory view showing the locus of the resist liquid regurgitation nozzle at the time of making resist liquid breathe out succeedingly from the condition of drawing 13 , and setting the regurgitation halt point of resist liquid as the center section of a wafer.
[Drawing 15] It is the explanatory view showing relation with the passing speed of the resist liquid regurgitation nozzle in each point on a wafer at the time of moving a resist liquid regurgitation nozzle on the diameter of a wafer.
[Drawing 16] It is the explanatory view showing the locus of the resist liquid regurgitation nozzle at the time of carrying out acceleration migration of the resist liquid regurgitation nozzle from the periphery of a wafer to a center section.
[Drawing 17] It is the explanatory view showing the locus of the resist liquid regurgitation nozzle at the time of carrying out slowdown migration of the resist liquid regurgitation nozzle from the condition of drawing 16 to the periphery of a wafer succeedingly.
[Drawing 18] It is the explanatory view showing the locus of the resist liquid regurgitation nozzle at the time of carrying out slowdown migration of the resist liquid regurgitation nozzle from the center

section of a wafer to the periphery of a wafer.
[Drawing 19] It is the explanatory view showing the locus of the resist liquid regurgitation nozzle at the time of carrying out acceleration migration of the resist liquid regurgitation nozzle by return from the condition of drawing 18 to the center section of a wafer.
[Drawing 20] It is the explanatory view showing relation with the rotational speed of the wafer in each location on the wafer of the resist liquid regurgitation nozzle at the time of moving a resist liquid regurgitation nozzle on the diameter of a wafer.
[Drawing 21] It is the explanatory view showing the example of a configuration which carries out adjustable [of the amount of mixing of resist liquid and a solvent].
[Drawing 22] It is the explanatory view showing the rotational speed of the wafer in each point on the wafer in which other examples of control of the rotational speed of the wafer at the time of moving a resist liquid regurgitation nozzle on the diameter of a wafer are shown.
[Drawing 23] It is an explanatory view for explaining the method of application of the resist liquid concerning the gestalt of other operations of this invention.
[Drawing 24] It is the table showing the relation between the passing speed of the resist liquid regurgitation nozzle in each point on the wafer of drawing 23 , and the rotational speed of a wafer.
[Drawing 25] It is the explanatory view showing the configuration of the acceptance member which catches the resist liquid breathed out from a resist liquid regurgitation nozzle.
[Drawing 26] It is the explanatory view showing the physical relationship of the resist liquid regurgitation nozzle at the time of moving from the periphery of a wafer to the center section of the wafer which is the regurgitation initiation point of resist liquid, and the acceptance member of drawing 25 .
[Drawing 27] It is the explanatory view showing the physical relationship of signs that regurgitation initiation of the resist liquid is carried out in the center section of the wafer which is the regurgitation initiation point of resist liquid, and the acceptance member of drawing 25 at that time.
[Drawing 28] It is the explanatory view showing the physical relationship of the resist liquid regurgitation nozzle when applying resist liquid to the periphery of a wafer, and the acceptance member of drawing 25 .
[Drawing 29] It is the explanatory view showing the example of a configuration of the gestalt of the operation which has two resist liquid regurgitation nozzles.
[Drawing 30] It is the explanatory view showing the example of a configuration of the gestalt of the operation which has the adjustable device which carries out adjustable [of the include angle to make] to a resist liquid regurgitation nozzle and a wafer.
[Drawing 31] It is the top view showing the example of a configuration of the gestalt of the operation which carries out the regurgitation of the resist liquid for a wafer top to a wafer from a resist liquid regurgitation nozzle with a bonnet with covering.
[Drawing 32] It is a front view at drawing 31 .
[Drawing 33] It is the explanatory view showing the example of a system configuration concerning the gestalt of the operation which has the process to which a control activation process is made to carry out preferentially.
[Drawing 34] It is the flow chart which shows actuation of a system to drawing 33 .
[Description of Notations]
1 Spreading Processing Equipment
15 17 Resist spreading processing unit
60 Resist Liquid Supply Means
65 Solvent Supply Means
70, 74, 75, 76 Nozzle holder
73 Maintenance Device
81 Scanning Device
82 Scanning Arm
90 Acceptance Member
91 Migration Member
S1, S2, S3, S4 Solvent supply nozzle
N1, N2, N3, N4 Resist liquid regurgitation nozzle

A, B Periphery
C Center section
W Wafer

[Translation done.]

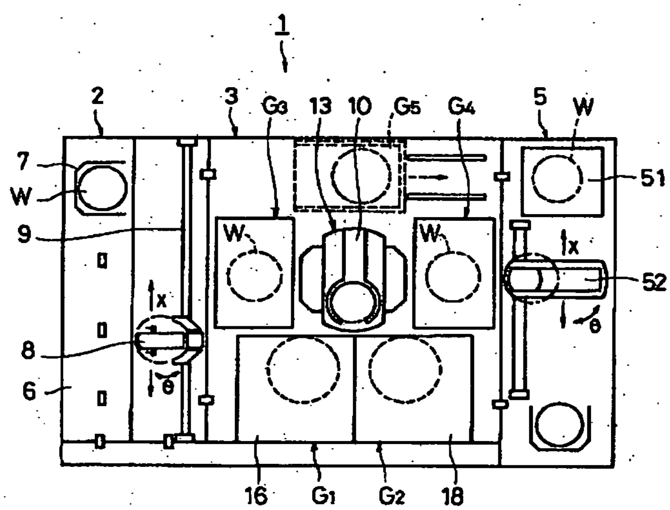
* NOTICES *

JPO and NCIPI are not responsible for any damages caused by the use of this translation.

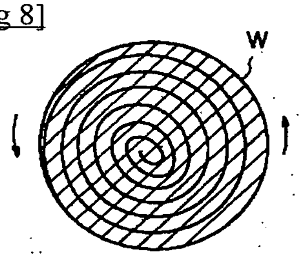
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

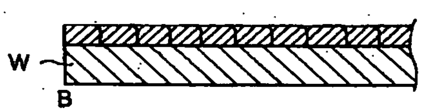
[Drawing 1]



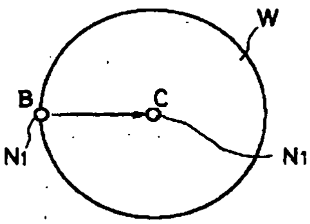
[Drawing 8]



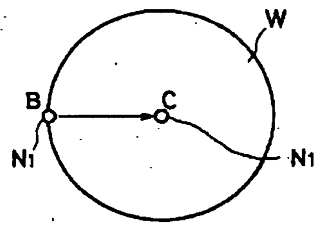
[Drawing 9]



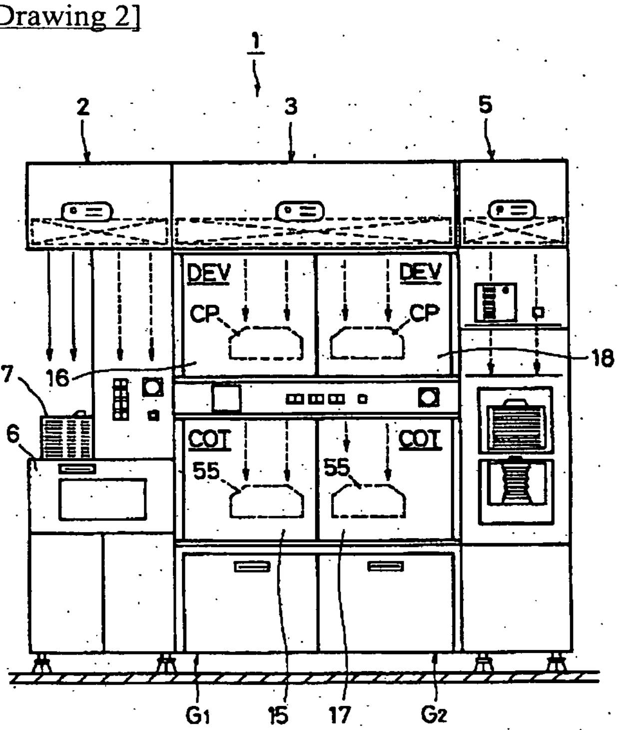
[Drawing 16]



[Drawing 17]



[Drawing 2]



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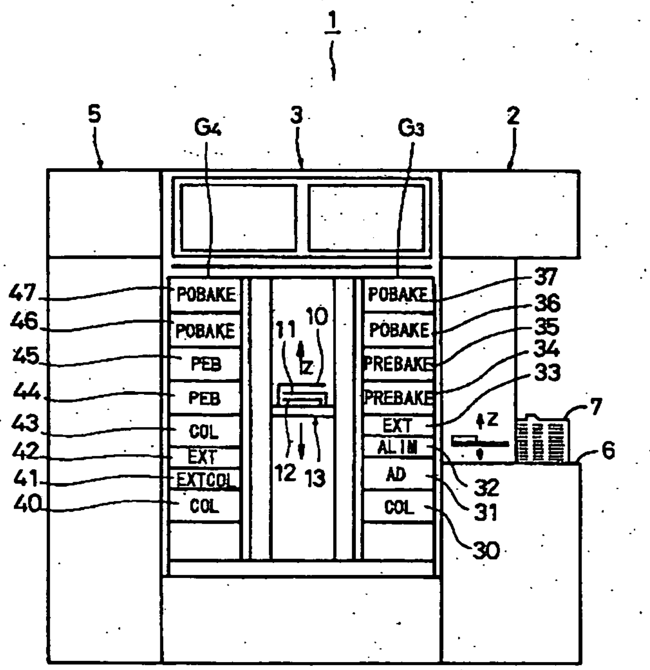

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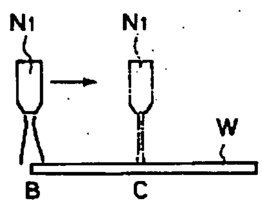
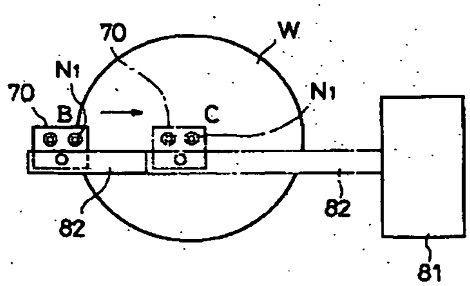
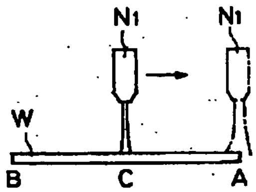


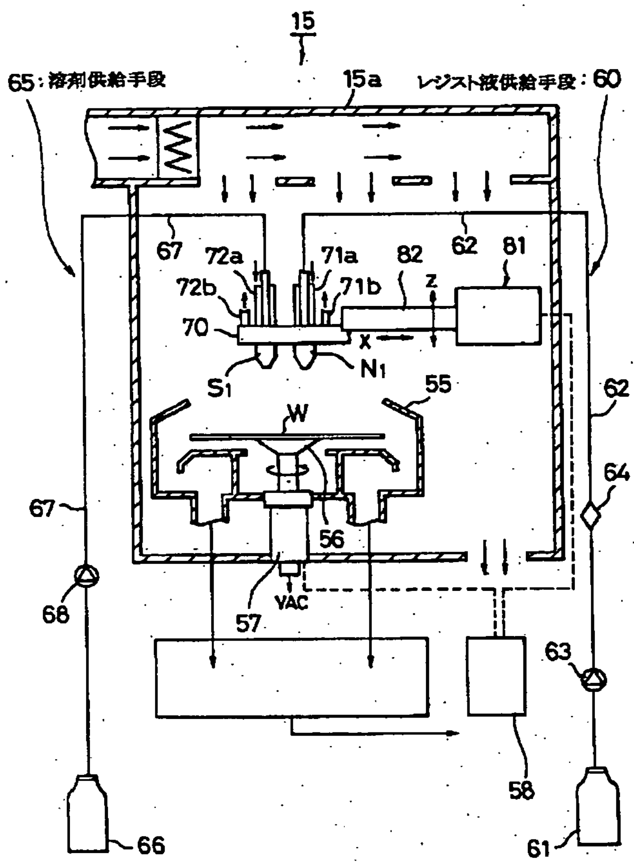
[Drawing 7]



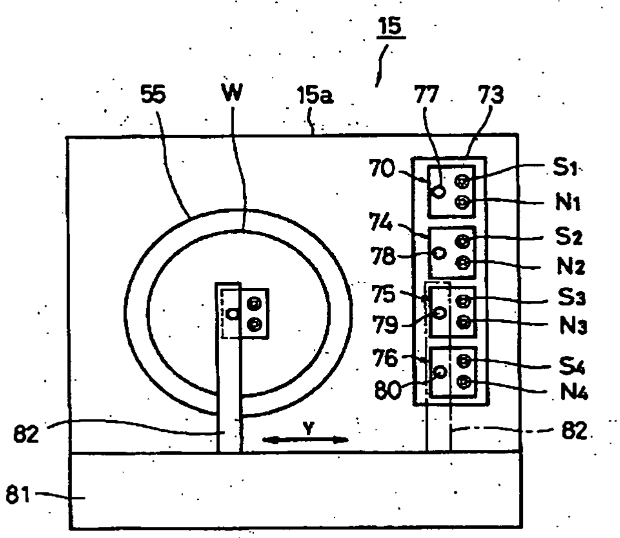
[Drawing 10]



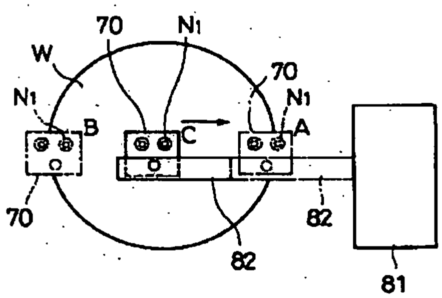
[Drawing 4]



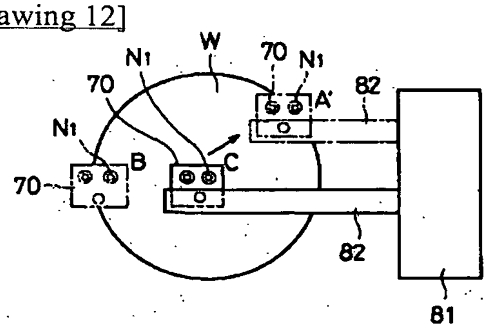
[Drawing 5]



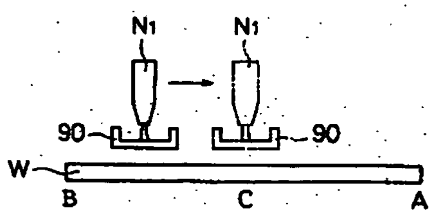
[Drawing 11]



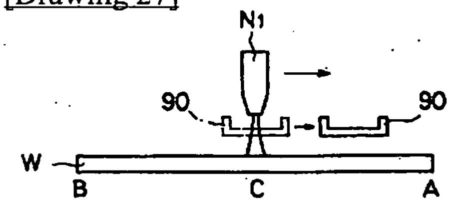
[Drawing 12]



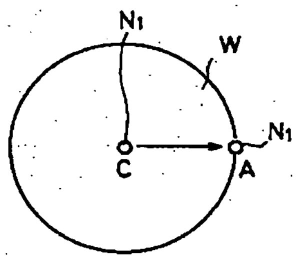
[Drawing 26]



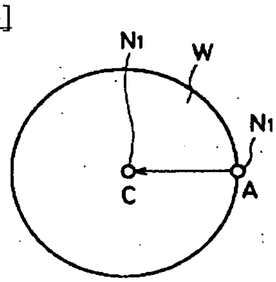
[Drawing 27]



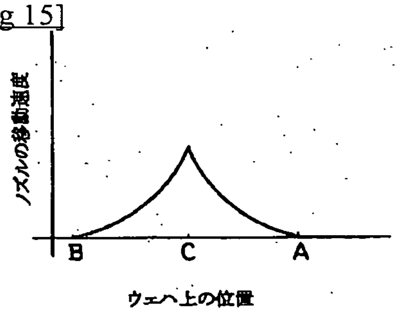
[Drawing 13]



[Drawing 14]



[Drawing 15]



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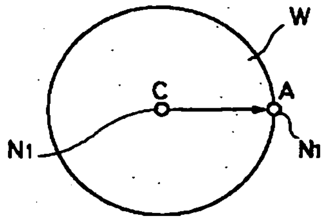
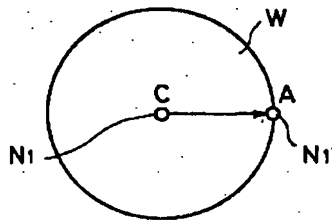


[Drawing 19]



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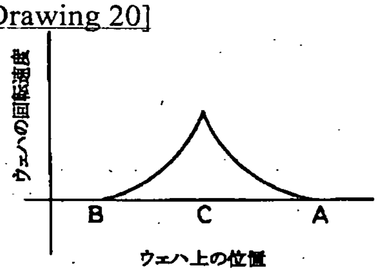
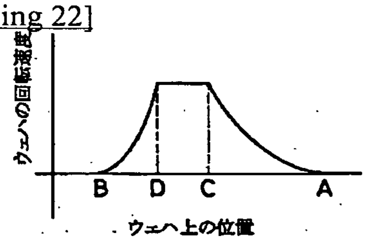


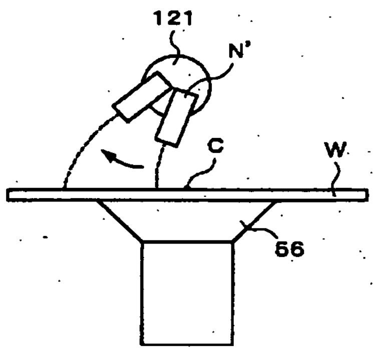
[Drawing 22]



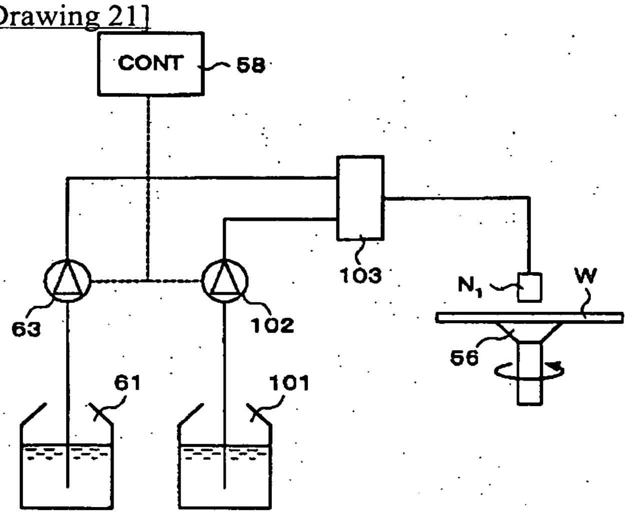
[Drawing 24]

ウェハ上の通過点	E	F	G	H	J	K	A
ノズルの移動速度 (mm/sec)	32	16	8	4	2	1	0
ウェハの回転速度 (rpm)	1920	960	480	240	120	60	

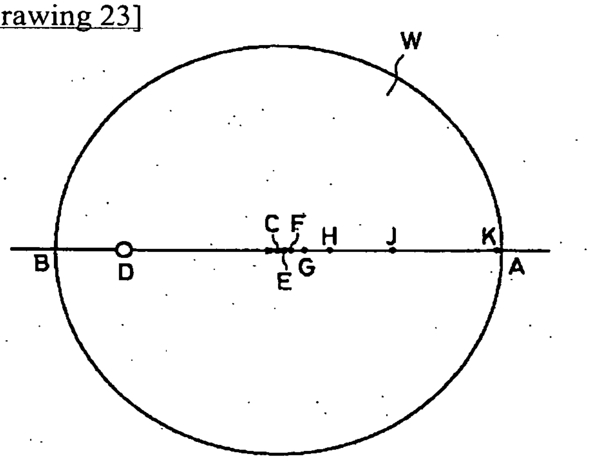
[Drawing 30]



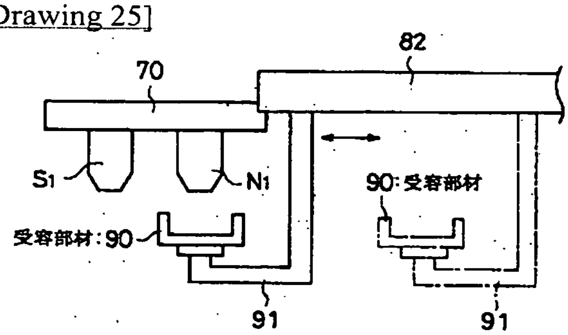
[Drawing 21]



[Drawing 23]



[Drawing 25]



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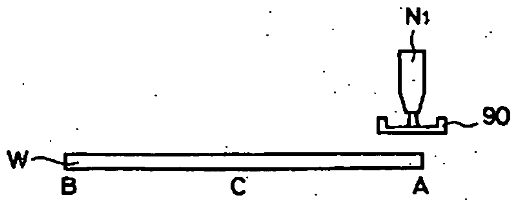
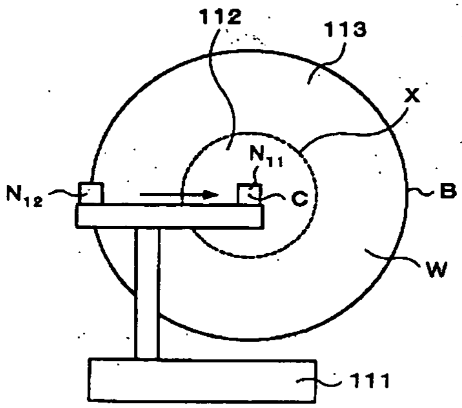
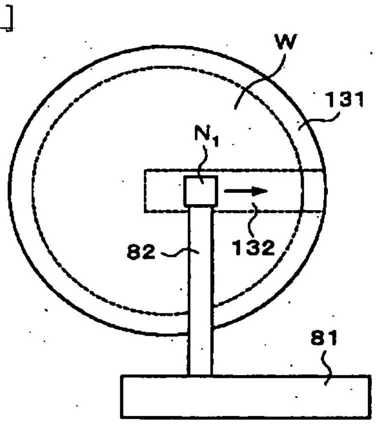


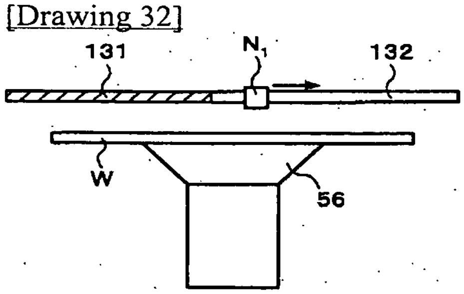
[Drawing 29]



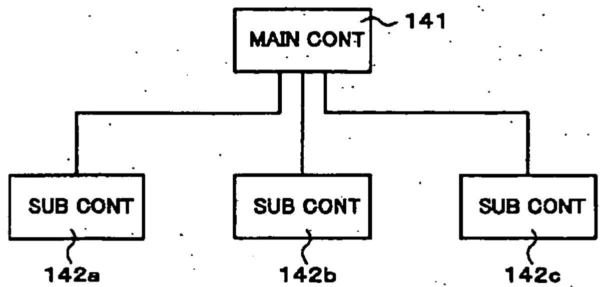
[Drawing 31]



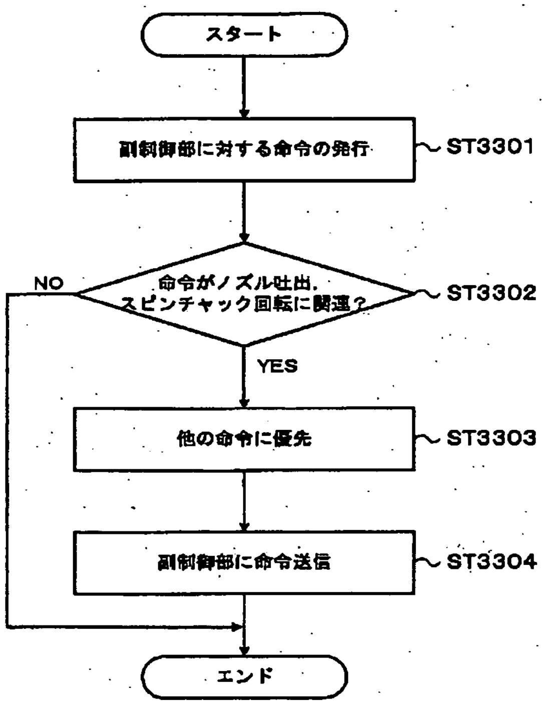
[Drawing 32]



[Drawing 33]



[Drawing 34]



[Translation done.]